भारतीय मानक
Indian Standard

IS 2372 : 2021

प्रशीतन टावरों के लिए इमारती लकड़ी — विशिष्टि

(तीसरा पुनरीक्षण)

Timber for Cooling Towers — Specification

(Third Revision)

ICS 79.040

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भारतीय मानक ब्यूरो
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January 2021 **Price Group 3**

Timber and Timber Stores Sectional Committee, CED 09

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Timber and Timber Stores Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was first published in 1963 and subsequently revised in 1991 and 2004. In the second revision, permissible defects in different grades of timber for cooling towers were also rationalized and the standard was brought in uniformity with the style of other standards on grading of timber. This revision has been brought out based on the experience gained in the use of timbers in cooling towers. In this revision, the following modifications have been incorporated:

a) Permissible stress for all species of timber, whether indigenous or imported, have been specified;

b) Criteria for employing timber in load bearing sections and restricting certain species of timber to only fill areas, based on minimum safe permissible stress, has been included; and

c) Permitted defects with respect to knot and check have been modified.

For the properties of new species, assistance has been derived from the following publications:

> Mechanical properties of woods grown in the United States, United States Department of Agriculture Bulletin, 556, p. 47 (1917).
>
> New Zealand Radiata pine: A technical appraisal of produce, processes, and uses, Ministry of Forestry, Forest Research Institute, New Zealand, p. 27 (1988).

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TIMBER FOR COOLING TOWERS — SPECIFICATION

(Third Revision)

1 SCOPE

This standard covers the species, grades, requirements and treatment of timber used in the construction of cooling towers.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
401 : 2001	Preservation of timber — Code of practice (*fourth revision*)
707 : 2011	Glossary of terms applicable to timber technology and utilization (*third revision*)
883 : 2016	Design of structural timber in buildings — Code of practice (*fifth revision*)

3 TERMINOLOGY

For the purpose of this standard, the definition given in IS 707, and the following shall apply.

3.1 Columns — The main vertical supporting members in the tower framework.

3.2 Fill — These are either splash bars or splash slats. Splashing of water takes place on these bars or slats.

3.3 Joists and Beams — Horizontal members to support imposed and dead loads, such as supports for fan deck flooring, filling drift eliminator, cold and hot water collecting and redistributing basins, water troughs, piping and mechanical equipment.

4 SPECIES OF TIMBER

The species of timber suitable for cooling towers shall be as given in Table 1.

5 GRADING OF TIMBER

5.1 Depending on the defects permitted (*see* **5.3**), cooling tower timbers shall be of three grades, namely:

a) Select grade,
b) Grade I, and
c) Grade II.

5.2 Prohibited Defects (for All Grades)

Timber with loose grain, reaction wood, heartwood rot, warp, worm holes which are likely to affect strength, pitch pockets, centre heart (pith), shakes twisted grain and wane shall not be selected for cooling towers.

Table 1 Timbers for Cooling Towers

(*Clause* 4)

Sl No.	Botanical Name	Trade Name	Permissible Stress in Grade- I Timber (N/mm^2) Bending and Tension Along Grain, Extreme Fibre stress (Inside location)
(1)	(2)	(3)	(4)
i)	*Abies pindrow*	Fir	8.1
ii)	*Cedrus deodara*	Deodar	10.2
iii)	*Picea smithiana*	Spruce	7.4
iv)	*Pinus kesiya*	Khasi pine	8.9
v)	*Pinus roxburghii*	Chir	8.5
vi)	*Pinus wallichiana*	Kail	6.6
vii)	*Pseudotsuga menziesii*	Douglas fir	9.1
viii)	*Pinus radiata*	Radiata pine	6.8
ix)	*Tectona grandis*	Teak	15.5

NOTE — Minimum safe permissible stress (at inside location) is 8.5 N/mm^2 as per IS 883. Hence, those species which do not meet this requirement should be avoided for use in load bearing sections. They may be used in the fill areas after proper treatment as per IS 401.

5.3 Permissible Defects

The defects to the extent specified in Table 2 for different grades of timber shall be permissible.

6 DIMENSIONS AND TOLERANCES

6.1 The suggested nominal sizes, rough and finished dimensions for various thicknesses are given in Table 3.

6.2 Tolerances

A 5 mm tolerance in length shall be permissible. In other dimensions, no minus tolerances shall be permitted but a maximum plus tolerance of 2 mm shall be permitted.

7 TREATMENTS

The following treatments are recommended:

a) The structural members and the shell members are to be treated to a net retention of 12 kg/m^3 of timber with copper-chrome-arsenic (CCA) or acid-copper-chrome (ACC) or 16 kg/m^3 of copper-chrome-boron (CCB) or 128 kg/m^3 of creosote/fuel oil mixture in accordance with IS 401.

b) Fill is to be treated under pressure with a minimum average retention of 16 kg/m^3 of timber with copper-chrome-arsenic (CCA) or acid-copper-chrome (ACC) or 20 kg/m^3 of copper-chrome-boron (CCB) or 160 kg/m^3 of creosote/fuel oil mixture in accordance with IS 401.

7.1 Penetration of Preservatives

The depth of penetration of the preservative shall be as given in Table 4.

Table 2 Permitted Defects for Different Grades of Timber for Cooling Towers

(*Clause* 5.3)

Sl No. (1)	Defects (2)	Select Grade (3)	Grade I (4)	Grade II (5)
i)	Slope of grain	Slope of grain shall not exceed 1 in 18	Slope of grain shall not steeper than 1 in 12	Slope of grain shall not exceed 1 in 8
ii)	Knot	Both on narrow and wide face up to 50 mm, the diameter of knots shall not be more than one fifth of the face. Beyond 50 mm face the diameter of knots shall not be more than one sixth of the face. Such knots shall not be more than one per any given 1.5 m length	Both on narrow and wide face up to 50 mm, the diameter of knots shall not be more than one fifth of the face. Beyond 50 mm face the diameter of knots shall not be more than one sixth of the face. Such knots shall not be more than one per any given 1 m length	Both on narrow and wide face up to 50 mm, the diameter of knots shall not be more than one fifth of the face. Beyond 50 mm face the diameter of knots shall not be more than one fifth of the face. Such knots shall not be more than two per any given 1 m length
iii)	Check	Check up to 3 mm in depth shall be allowed	Check up to 5 mm in depth shall be allowed	Check up to 5 mm in depth shall be allowed
iv)	End split	End split shall be minmum 150 mm or 25 percent of overall length	End split shall be minmum 150 mm or 33 percent of overall length	End split shall be minmum 150 mm or 33 percent of overall length

Table 3 Nominal and Dressed Dimensions

(*Clause* 6.1)

All dimensions in millimetres.

Nominal rough thickness or Width	25	32	38	50	75	Over 100 (for example, X)
Minimum rough sawn thickness or Width	23	30	35	47.5	72.5	X-5
Dressed thickness or Width	21	27	32	45	70	X-10

Table 4 Depth of Penetration of Preservative in Different Species of Timber
(*Clause* 7.1)

Sl No.	Botanical Name	Depth, *Min*	
		Sapwood (in Percent)	Heartwood, in mm
(1)	(2)	(3)	(4)
i)	*Abies pindrow*	100	5[1]
ii)	*Cedrus deodara*	100	10
iii)	*Pseudotsuga taxifolia*	100	5[1]
iv)	*Picea smithiana*	100	5[1]
v)	*Pinus kesiya*	100	20
vi)	*Pinus radiata*	100	20
vii)	*Pinus roxburghii*	100	20
viii)	*Pinus wallichiana*	100	10
ix)	*Tectona grandis*	100	Needs no treatment

[1] For structural member, incision about 15 mm should be made on all surfaces (except end) to achieve the required absorption.

8 MARKING

8.1 Each piece shall be legibly and indelibly marked with the following particulars:

a) Manufacturer’s name, brand name or his recognized trade-mark, if any;
b) Grade
c) Year of supply; and
d) Batch number.

NOTE — A batch shall consist of the timber of cooling tower of one species, grade and dimensions manufactured under similar conditions.

8.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Timber and Timber Stores Sectional Committee, CED 09

Organization	*Representative(s)*
Forest Research Institute, Dehradun	Shri A. S Rawat (***Chairman***)
All India Sports Goods Manufacturers Federation, Meerut	Representative
Bamboo Society of India, Bengaluru	Shri V. P. Hiremath Shri U. T. Alva (*Alternate*)
Cane and Bamboo Technology Centre, Guwahati	Shri Nipan Deka
Central Public Works Department, New Delhi	Representative
Chhattisgarh Rajya Van Vikas Nigam Ltd, Raipur	Shri R. K. Sharma Shri B. K. Sinha (*Alternate*)
CSIR - Central Building Research Institute, Roorkee	Dr B. Singh Dr Manorama Gupta (*Alternate*)
Directorate of Standardization (Ministry of Defence), New Delhi	Dr K. C. Gupta Shri Jitendra Kumar (*Alternate*)
Federation of Indian Plywood & Panel Industry, New Delhi	Shri Ajay Baldawa Shri Anthony Fernanedes (*Alternate*)
Forest Research Institute, Dehradun	Dr Sadhna Tripathi
Himachal Pradesh Forest Corporation Ltd, Shimla	Managing Director Execitive Director (*Alternate*)
Indian Council of Forestry Research and Education, Dehradun	Director General
Indian Plywood Industries Research & Training Institute, Bengaluru	Shri Uday D. Nagammanavar Shri Anand Nandanwar (*Alternate*)
Institute of Wood Science & Technology, Bengaluru	Shri S. C. Joshi Dr S. K. Sharma (*Alternate*)
Karnataka State Forest Industries Corporation Ltd, Bengaluru	Managing Director Representative (*Alternate*)
Kerala Forest Research Institute, Thrissur	Dr T. K. Dhamodaran Dr E. M. Muralidharan (*Alternate*)
Kutty Flush Doors & Furnitures Co Pvt Ltd, Chennai	Shri K. Sankara Krishnan
Madhya Pradesh Rajya Van Vikas Nigam Ltd, Bhopal	Shri A. S. Joshi Shri Atul Jain (*Alternate*)
Mazagon Dock Limited, Mumbai	Shri N. J. Gosavi Shri A. J. Das (*Alternate*)
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Ministry of Environment, Forest and Climate Change, New Delhi	Shri Deepak Kumar Sinha
Naval Dockyard Mumbai, Mumbai	Shri Prabhakar Ganpat Mirashi
Railway Board (Track Directorate), Ministry of Railways, New Delhi	Representative
The Rubber Board, Kottayam	Shri N. Rajagopal

Organization	*Representative(s)*
Timber Importer Association, Kandla	Representative
Uttar Pradesh Forest Development Corporation Ltd, Lucknow	Representative
Uttarakhand Bamboo and Fibre Development Board, Dehradun	Representative
WIMCO Limited, Rudrapur	Dr Ramesh Chandra Dhiman Shri J. N. Gandhi (*Alternate*)
Wood Technology Association, Yamuna Nagar	Shri S. C. Jolly Shri Manoj Gwari (*Alternate*)
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Scientist 'C' (Civil Engineering), BIS

Timber Terminology, Conversion, Seasoning, Preservation, Grading and Testing Subcommittee, CED 9:1

Organization	*Representative(s)*
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Borax Morarji Limited, Thane	Shri H. T. Kapadia Shri S. Rangarajan (*Alternate*)
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Institute of Wood Science & Technology, Bengaluru	Dr S. R. Shukla
Karnataka State Forest Industries Corporation, Bengaluru	Managing Director Representative (*Alternate*)
Kutty Flush Doors & Furnitures (Pvt) Ltd, Chennai	Shri K. Sankarakrishnan Col Y. G. Krishnan (*Alternate*)
Kerala Forest Research Institute, Peechi	Dr T. K. Dhamodaran
Madhya Pradesh Rajya Van Vikas Nigam Limited, Bhopal	Shri A. S. Joshi Shri Atul Jain (*Alternate*)
Ministry of Environment, Forest and Climate Change, New Delhi	Shri Deepak Kumar Sinha
Office of Development Commissioner (Handicrafts) Ministry of Textile Govt. of India, New Delhi	Deputy Director
Paharpur Cooling Towers Limited, Kolkata	Shri S. Ramasundar Shri Abhijit Samui (*Alternate*)
Rubber Research Institute of India, Kottayam	Director
Uttarakhand Forest Development Corporation Ltd, Dehradun	Principal Chief Conservator of Forests General Manager (*Alternate*)
Western India Plywoods Ltd, Kannur	Shri P. K. Mavan Dr K. Raghunathan (*Alternate*)
In personal capacity (*C/o American Connexion, 214, Phase II, Vasant Vihar, Dehradun 248006, Uttaranchal*)	Dr Satish Kumar

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